eHealth-as-a-Service (eHaaS): towards universal stakeholder engagement

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***Abstract*—With the introduction of the Personally Controlled Health Record (PCEHR), the Australian public is being asked to accept greater responsibility for their healthcare by taking an active role in the management of personal health information. Although well designed, constructed and intentioned, policy and privacy concerns have resulted in an eHealth model that may impact future health sharing requirements. Hence, as a case study for a consumer eHealth initative in the Australian context, eHealth-as-a-Service (eHaaS) serves as a disruptive step in in the aggregation and transformation of health information for use as real-world knowledge. The strategic value of extending the community Health Record Bank (HRB) model lies in the ability to automatically draw on a multitude of relevant data repositories and sources to create a single source of the truth and to engage market forces to create financial sustainability. The opportunity to transform the beleaguered Australian PCEHR into a realisable and sustainable technology consumption model for patient safety is explored. Moreover, the current clerical focus of healthcare practitioners acting in the role of de facto record keepers is renegotiated to establish a shared knowledge creation landscape of action for safer patient interventions. To achieve this potential however requires a platform that will facilitate efficient and trusted unification of all health information available in real-time across the continuum of care. eHaaS provides a sustainable environment and encouragement to realise this potential.**

Keywords—PCEHR; eHealth; data-driven; cloud computing; SOA; eHaaS

I. INTRODUCTION

While the goal of eHealth programs is to deliver safe, efficient, high quality healthcare, the complexities of healthcare coupled with stakeholder perception and acceptance have emerged as significant challenges for ubiquitous adoption. In this connection with the introduction of the Australian PCEHR (Personally Controlled Electronic Health Record) program, the National E-Health Transition Authority (NEHTA) have implemented an open standards infrastructure that aspire to common thematic priorities of international eHealth programs. However, the implementation of the PCEHR has resulted in poor adoption rates and criticism from stakeholders with concerns about transparency, accountability (for example, privacy, confidentiality and information security), and limited functionality.

With a view to locating our research within the broader eHealth domain, we have completed a preliminary literature review and have identified a paucity of research into the impact of data-driven approaches on clinical decision making in the Australian context. Further, questions relating to sociotechnical factors concomitant with analogous eHealth programs begin to emerge for example: What constitutes an effective data-driven framework for support of quality decision making and co-ordinated care management in a complex multi-disciplinary environment? What are the key drivers and barriers in the adoption of a data-driven framework?

The research program seeks to answer these and related questions in order to establish a sociotechnical lens for the examination of current state and future state information unification frameworks and technology consumption models. This in turn will guide the development of innovative care process models (evidence based vs. data-driven vs. expert opinion) and a recommendation for an adaptive data-driven approach to collect and make available individualised recommendations for patients at the point of care.

II. DEFINING EHEALTH-AS-A-SERVICE

Healthcare is first and foremost a service. To that end, high quality service delivery is as much about art as it is about science. Striking that all important balance between the two requires the orchestration of art that is concerned with a consumer's perception of usability and value and science that appeals to the functionality and capability of the underlying systems. Drawing a connection between this sociotechnical perspective and the implementation of the PCEHR provides valuable insight into the challenges associated with implementing large scale eHealth programs. There is growing evidence that enthusiasm by health leaders and policy makers for new technologies is not always reflected by adoption and utilisation in practice due to complex socio-technical factors. Moreover, it is argued that a focus on technology over the formulation of a well-defined value proposition have resulted in many ehealth project failures [1]. We contend that the consumption of information technology within the healthcare domain requires a shift in focus from technology to service.

eHealth-as-a-Service (eHaaS) offers an alternative stakeholder-centric framework that establishes the PCEHR as the keystone of a holistic eHealth 'as a service' framework

unifying longitudinal patient data from disparate sources. As the building blocks of an eHealth system, personal health records (PHR), electronic medical records (EMR) and Electronic Health Records (EHR) are encapsulated in the eHaaS framework with the interconnections comprising human behaviour and information flow a key design consideration [2]. As key value propositions data enrichment, co-creation and discovery require a platform that will encourage cooperation and collaboration across organisational boundaries as evidenced by social media platforms. Thus, healthcare organisations need to re-evaluate traditional boundaries due to the complexity of eHealth technologies necessary for collaboration and co-creation [3] (Refer Fig 1).

There is consensus in literature that a significant challenge for delivering large-scale programs is 'one size does not fit all' [4]. For that reason we contend that an "on demand computing" construct, specifically Software-as-a-Service (SaaS) that often includes hosting and infrastructure services and recognised for its efficacy in other domains, may be observed successfully in healthcare settings. In simple terms, eHaaS will establish low cost, on-demand capability for the delivery of service models designed to individual stakeholder requirements. As an extension of the health record bank (HRB), a model predicated on a community organisation approach with patients playing a gatekeeper role for a copy of all their personal and private health information. The model will resolve privacy issues, increase stakeholder cooperation, deliver improved financial sustainability and enable coexistence with institutions that maintain their own local copies [5].

The architectural core of eHaaS utilize cloud computing, application programming interfaces (API) and a service oriented architecture (SOA) based platform to deliver a rich functionality required to support complex multidisciplinary workflows. Similarly, the growing commoditisation of data requires a consolidation of cloud services that provide seamless and efficient access to health information from multiple platforms at any time from any location. However, services must be aligned to operational requirements in order to create value specific to the individual needs of the stakeholders. Thus, at the operational level, eHaaS offers a framework for identifying service models that will facilitate value creation, collaboration and decision support across the continuum of care. In this context the opportunity to address diverse perspectives inherent in eHealth programs illustrate the potential for collaboration and co-creation leveraging eHaaS (Refer Fig 2).

III. Towards universal stakeholder engagement

Individualised healthcare is predicated on providing the ability for stakeholders to extract and distil meaningful information from a broad and pervasive digital landscape. Moreover, the cumulative value creation effect achieved by applying contextual knowledge as information feedback loops within a patient's knowledge network emerges. As an integral component of the eHaaS construct, this knowledge network will grow in value over the life of the patient increasing the efficacy of predictive modelling, informing individualised preventative and intervention strategies while contributing to population health and broader research efforts. In conjunction with the PCEHR these systems will intelligently integrate personal information with an individualised form of evidence for collaborative decision making and co-creation by the practitioner and patient [7] (Refer Fig 3).

IV. Future Directions

When surveying the literature there is an abundance of novel enabling technologies delivering improvements in the quality, safety and efficiency of healthcare. However, there remains a significant disconnect between the promise and reality in the delivery of eHealth [8]. While a connection to national and international health policy is drawn through the recognition that consumer engagement is critical to quality improvement and cost containment, a United States study provides valuable insight into the importance of practitioner engagement and endorsement for successful stakeholder adoption of consumer health record systems [9]. This helps to pinpoint questions for future inquiry into the implications of universal stakeholder engagement in the healthcare domain. Future research efforts will examine the underlying value chains in healthcare and develop individualised value propositions aligned with individual stakeholder expectations.

V. Conclusion

The findings from a preliminary literature review highlights a discrepancy between what is known and how research will contribute to current knowledge. The promise of encapsulating eHealth services in an 'on demand' computing construct is strong. However, further work is required to realise the potential for a sustainable framework to extract value from the unification of human-centered data. The outcome of this scientific discourse will lead to an understanding of the socio-technical factors required for the adoption of a data-driven framework suitable for the Australian healthcare context.

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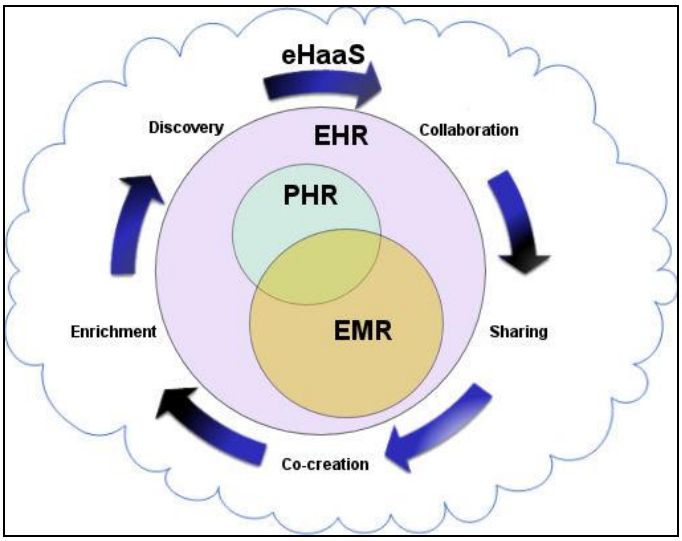

Fig. 1. A stakeholder-centric model, adapted from [2].

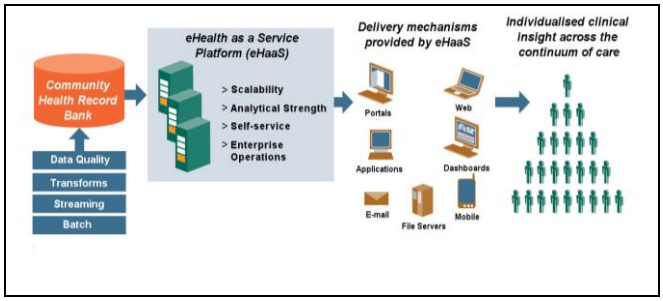

Fig. 2. eHaaS conceptual model, adapted from [6].

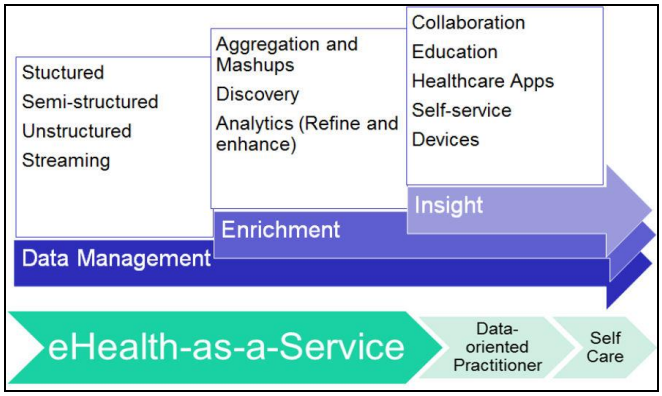

Fig. 3. eHaaS integration into Healthcare.